

### REMARKS

In the Office Action dated April 18, 2005, claim 20 was rejected under 35 U.S.C. § 112, second paragraph as being indefinite. Claims 19-21, 25 and 29-31 were rejected under 35 U.S.C. § 102(e) as being anticipated by the Pineda et al. (Pineda) 6,551,396 patent. Claims 36 and 42 were provisionally rejected under the judicially created doctrine of obviousness type double patenting as being unpatentable over claim 16 and 22 of co-pending application Serial No. 10/614,601. Claims 22-24, 26-28 and 32-35 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Pineda in view of either Japanese Patent Publication No. JP 61-245938 or U.S. Patent No. 6,416,572 of Eldemallawy et al. (Eldemallawy). Claims 1-4, 7-9, 12, 15-18, 36 and 39-42 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Pineda in view of U.S. Patent No. 2,968,848 to Carter et al. (Carter). Claims 5 and 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Pineda in view of Carter and further in view of either the Japanese reference or Eldemallawy. Claims 10-11 and 13-14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Pineda in view of Carter and in view of either U.S. Patent No. 5,158,130 to Sahari or U.S. Patent No. 5,915,452 of Conroy et al. (Conroy). Claims 37-38 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Pineda in view of Carter and in further view of U.S. Patent No. 4,580,616 of Watts. For the reasons outlined in detail below, it is respectfully submitted that the pending claims are patentable over the references of record.

The Examiner is thanked for the courtesy of providing an interview to the applicants and their representative on July 5, 2005. During the interview, a discussion was had concerning certain proposed changes to the claims. A discussion was also conducted concerning the art of record, particularly Carter and Pineda.

It was pointed out during the interview that Carter particularly teaches the immersion of its shell mold 20 into its bath 22 "until the molten metal therein solidifies and preferably for some time interval thereafter", since this "is important in the practice of the invention" (see column 3, lines 48-51). It was also noted that Carter particularly teaches that his shell "must be self supporting in the sense that it can be moved into the liquid coolant" (see column 4, lines 32-34). Carter further teaches that his poured mold, with the metal in it still in a fluid condition, should be immersed in the body of liquid 22 and that it should be maintained in the liquid until the molten metal solidifies (see column 3, lines 26-27). The

purpose given in Carter for immersing molten metal, held in a mold, in a liquid bath is that the bath has very high heat transfer properties. Carter particularly notes that the liquid used as a coolant “acts essentially to conduct heat away from the mold and establish a controlled cooling rate” (see column 2, lines 61-63). Thus cooling in Carter takes place through the mold.

There is no teaching or disclosure in Carter of removing at least a portion of the mold during the process of cooling the molten metal, and prior to complete solidification of the molten metal into a casting. Accordingly, it is respectfully submitted that Carter fails to teach the step of removing at least a part of the mold prior to complete solidification of the molten metal into the casting, as is recited in claim 1.

Pineda is similarly deficient. In the Office Action, it was asserted that Pineda teaches a water dispersible mold and a method of investment casting for metal by using the mold. The Pineda method was said to comprise using mold having a water soluble binder and including phosphate and silica sand, having lower heat diffusivity than metal, for the purpose of coating a pattern and forming a water dispersible mold and then casting metal by an investment casting method. Pineda was also said to teach a method of dropping the mold into water to create a heat differential to crack a portion of the mold. Finally, Pineda was said to teach the use of controlling and reducing binder and increasing silica sand or filler for the purpose of making the investment softer and easier to remove from the casting metal in order to remove or crack a portion of the water dispersible mold from the casting.

However, as with Carter, there is no teaching or disclosure in Pineda of removing at least a part of the mold prior to complete solidification of the molten metal into a casting, as is recited in claim 1. More particularly, Pineda merely discusses various phosphate bonded compositions and molds. But, Pineda particularly discusses the use of the mold to obtain a casting. Only after the casting is cooled and only after the mold is allowed to cool (see column 6, line 24) is the mold removed. Such removal is by grinding, sandblasting or the like (see column 6, line 25). Pineda particularly teaches sand blasting with glass beads (see column 6, lines 27-28). Alternatively, Pineda teaches dropping the mold into water to create a heat differential between the inner and outer surfaces to crack the mold (see column 6, lines 29-31). What is clearly missing from Pineda, as it was from Carter, is any teaching or disclosure of removing at least a part of the mold prior to complete solidification

of the molten metal in the mold into a casting.

It is respectfully submitted that there is no teaching or disclosure of the process for casting metals as recited in claim 1 in even the combination of Carter and Pineda. Accordingly, claim 1 is patentable over the applied combination of references. Moreover, claim 1 is patentable over the remainder of the cited art as well.

Dependent claims 2-4, 7-9, 12 and 15-18 merely further patentably define the detailed subject matter of their parent claim, or each other. As such, these claims are also believed to be in condition for allowance over the art of record.

Dependent claims 5 and 6 were rejected as being unpatentable over Pineda in view of Carter and in further view of the Japanese reference or Eldemallawy. Claim 5 has been cancelled without prejudice. Claim 6 recites that the particulate material comprises glass, ceramic or refractory hollow spheres. For this purpose, the Examiner employs either the Japanese reference or Eldemallawy.

However, neither of these references teach or disclose what is missing from the combination of Pineda and Carter, namely, a process for casting metals including removing at least a part of the mold prior to complete solidification of the molten metal into the casting. Therefore, it is respectfully submitted that claim 6 also patentably defines over the four-way combination asserted against it.

Dependent claims 10, 11, 13 and 14 were rejected as being unpatentable over Pineda in view of Carter and in further view of either Sahari or Conroy. It was stated in the Office Action that Pineda in view of Carter fails to teach the use of controlling the dose of binder or the use of a water nozzle. Sahari was said to teach the use of nozzles and submerging the mold into water for the purpose of cooling and removing the casting and reusing the binder agent. Conroy was said to teach the use of nozzles having a flow rate and pressure and including water and a surfactant for the purpose of removing cores from castings. It was asserted that it would have been obvious for one having ordinary skill in the art to provide Pineda in view of Carter with the use of a water nozzle, as taught by Sahari or Conroy, in order to control the cooling of the casting in the molten state and to remove or crack the water soluble mold from the casting. However, neither Sahari or Conroy teaches or discloses the step of removing at least a part of the mold prior to complete solidification of the molten metal into a casting. As a result, even the four-way combination asserted against claims 10, 11, 13 and 14 is untenable. In other words, none

of the applied references, in any combination, teaches or discloses the subject matter of claims 10, 11, 13 and 14. Neither does the rest of the cited art. As a result, it is respectfully submitted that claims 10, 11, 13 and 14 are patentable over the art of record.

Claims 19-24 have been cancelled without prejudice.

Claim 25 was rejected as being anticipated by Pineda. Claim 25 has been amended to add the subject matter of claims 26 and 28 thereto. The later claims were rejected as being unpatentable over Pineda in view of either of the Japanese reference or Eldemallawy. It was stated the Pineda fails to teach the use of an amount of a heat resistant microsphere oxide, such as pumice or perlite. However, the Office Action contended that either the Japanese reference or Eldemallawy teaches the use of an amount of a heat resistant material, such as pumice or perlite, for the purpose of improving casting shaping quality and mold removability. This rejection is respectfully traversed.

Claim 25 has been amended to recite that the mold comprises a particular granular material which comprises a mixture of a) pumice, cenospheres, or ceramic, refractory or glass micro-bubbles, b) sand and c) a soluble binder, wherein the binder remains soluble so that the mold may be eroded away using a solvent. It is noted, again, that in Pineda, the mold is removed by sand blasting with glass beads or by dropping the mold into water to create a heat differential and crack the mold. Neither of these methods taught in Pineda is the same as or equivalent to eroding the mold away using a solvent, as is recited in claim 25. The deficiencies in Pineda are not cured by either the Japanese reference or Eldemallawy. In other words, none of the three applied references teaches or discloses a soluble binder, wherein the binder remains soluble so that the mold may be eroded away using a solvent.

Dependent claims 27 and 32-35 were rejected on the same grounds. These claims, since they merely further patentably define the detailed subject matter of their parent claim, are also believed to be in condition for allowance over the applied combination of references as well as the rest of the art of record.

Independent claim 36 was rejected provisionally under the judicially created doctrine of obviousness-type double patenting. Since this is only a provisional rejection, it will not be addressed at this point, except to state that should the application in Serial No. 10/614,601 issue into a patent, a suitable terminal disclaimer can then be filed.

More substantively, claim 36 was rejected as being unpatentable over Pineda in

view of Carter. For the same reasons advanced above in connection with independent claim 1, it is respectfully submitted that claim 36 is in patentable condition over the applied combination of references, as well as the remainder of the cited art.

Dependent claims 37 and 38 were rejected as being unpatentable in view of Pineda and Carter and in further view of Watts. Pineda and Carter were acknowledged to fail to teach the use of a solidified shell having a molten metal core or using the shell as a chill. It was contended that Watts teaches the use of a solidified shell having a molten metal core or using the shell as a chill, for the purpose of controlling a cooling rate and a microstructure of the casting. It was then stated that it would have been obvious to one of having ordinary skill in the art to provide Pineda in view of Carter with the use of a solidified shell having a molten metal core or using the shell as a chill as taught by Watts in order to effectively control the cooling rate and microstructure of the casting.

As with Pineda and Carter, there is no teaching or disclosure in Watts of removing at least a part of the mold and then solidifying and cooling at least a part of the molten metal to form a casting. Similarly to Carter and Pineda, Watts teaches a vessel for holding the molten metal while it is being cooled. There is no teaching or disclosure in Watts of removing at least a part of the vessel holding the molten metal, i.e, the mold, and then solidifying and cooling at least a part of the molten metal to form the casting. In other words, there is no teaching or disclosure in Watts, or the applied three way combination, of the steps recited in claims 37 and 38 as originally filed. Therefore, it is respectfully submitted that these claims patentably define over the three way combination asserted against it in paragraph 13 of the Office Action.

Dependent claims 39-42 merely further patentably define the detailed subject matter of their parent claim. As such, these claims are also believed to be in condition for allowance over the art of record for the reasons outlined above.

Applicant herewith submits new independent claim 43. This claim recites a process for the casting of metals comprising forming a mold, delivering a molten metal including aluminum into the mold, contacting the mold with a solvent, cooling a shell of solidified metal formed at an interface of the molten metal and the mold with the solvent, maintaining a quantity of molten metal within the shell and removing at least a portion of the mold with the solvent. This claim patentably defines over all of the applied references. In particular, claim 43 defines over Carter, Pineda or their combination because neither of these

references teaches or discloses a process for casting metals in which at least a portion of the mold is removed with a solvent while maintaining a quantity of molten metal within a shell of solidified metal. Neither does their combination. The remaining references of record also do not teach those elements of the process which are missing from Carter and Pineda. Accordingly, claim 43 is patentable over the art of record.

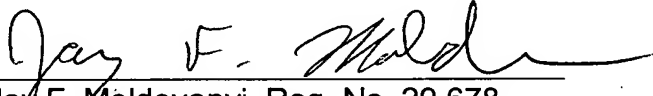
Dependent claims 44-51, which merely further patentably define the detailed subject matter of their parent claim, or each other, are also believed to be in condition for allowance over the art of record.

In view of the foregoing, it is respectfully submitted that all of the pending claims are in condition for allowance over the art of record. Such allowance is earnestly solicited.

Respectfully submitted,

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July 18, 2005  
Date

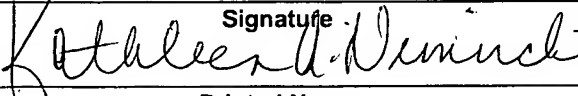
  
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